

**STUDENT DUST COUNTER: STATUS REPORT AT 40 AU.** M. Piquette<sup>1,3</sup>, A. R. Poppe<sup>2</sup>, E. Bernardoni<sup>3,4</sup>, J. R. Szalay<sup>5</sup>, D. James<sup>3</sup>, M. Horányi<sup>3,4</sup>, S. A. Stern<sup>6</sup>, H. Weaver<sup>7</sup>, J. Spencer<sup>6</sup>, C. Olkin<sup>6</sup>, and the New Horizons P&P Team

<sup>1</sup>Department of Astrophysical and Planetary Science, University of Colorado Boulder, Boulder, Colorado, USA.

<sup>2</sup>Space Science Laboratory, University of California Berkeley, Berkeley, California, USA.

<sup>3</sup>Laboratory for Atmospheric and Space Physics, Boulder, Colorado, USA.

<sup>4</sup>Department of Physics, University of Colorado Boulder, Boulder, Colorado, USA.

<sup>5</sup>Department of Astrophysical Sciences, Princeton University, New Jersey, USA.

<sup>6</sup>Southwest Research Institute, Boulder, Colorado, USA

<sup>7</sup>Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, USA

email: marcus.piquette@colorado.edu

Information on the distribution of interplanetary dust particles (IDPs) provides constraints to the origin and evolution of planetary bodies. The distribution of IDPs depends on the sources, sinks, and dynamics of dust grains permeating the solar system. Numerical models have demonstrated that outgassing and outbursts of Jupiter Family Comets (JFCs) dominate the distribution of IDPs in the inner solar system [1,2] while the mutual collisions and bombardment of Edgeworth-Kuiper Belt Objects (EKBOs) by interstellar/interplanetary grains dominate the distribution of IDPs in the outer solar system [3,4,5,6]. IDPs are subject to gravity, radiation pressure, EM forces, and Poynting-Robertson drag. Under these forces, IDPs migrate throughout the solar system, often getting trapped in resonances with or scattered by the giant planets [6,7,8]. Being able to accurately map the distribution of IDPs will provide insight into the parent bodies of the particles as well as the overall evolution of the solar system.

The Student Dust Counter (SDC) is an in-situ dust detector aboard the New Horizons spacecraft observing the distribution of IDPs in the mass range of  $10^{-12} < m < 10^{-9}$  g or approximately 0.5 - 5  $\mu\text{m}$  in radius. New Horizons was launched on January 19<sup>th</sup> 2006 and performed a fly-by of the Pluto system on July 14<sup>th</sup> 2015. SDC has nearly continuously mapped the dust density distribution along the trajectory of New Horizons from Earth to 40 AU. For grains  $> 0.62 \mu\text{m}$ , density initially increases out to 15 AU then remains fairly constant. The density of larger grains ( $> 0.9 \mu\text{m}$ ) has poorer statistics but has remained nearly constant, agreeing with Pioneer measurements [9].

Recent models have detailed the sources, sinks, and transport of dust particles in the outer solar system allowing for direct comparisons with SDC observations [6,10,11]. These models used a test particle approach, with collisional schemes introduced, integrating the motion of individual grains under the influence of gravity due to the Sun and the giant planets, radiation pressure, Poynting Robertson drag, electromagnet-

ic perturbation due to the interplanetary magnetic fields, and grain-grain collisions.

We present results of the dust density distribution from 1 to 40 AU and compare these measurements to existing theoretical models.

#### References:

- [1] Nesvorný, D., et al., (2010) *Astronomical Journal*, 713, 816-836. [2] Nesvorný, D., et al., (2011) *Astronomical Journal*, 743. [3] Stern, S. A., (1996) *Astronomy and Astrophysics*, 310, 999-1010. [4] Yamamoto, S., et al., (1998) *Astronomy and Astrophysics*, 329, 785-791. [5] Poppe, A. R., (2015) *Icarus*, 246, 352-359. [6] Poppe, A. R. (2016), *Icarus*, 264, 369-386. [7] Liou, J. C., et al., (1999) *Icarus*, 141, 13-28. [8] Moro-Martin, A., et al., (2002), *Astrophysical Journal*, 124, 2305-2321. [9] Humes, D. H. (1980) *Journal of Geophysical Research*, 85, 5841-5852. [10] Vitense, C., et al., (2012) *Astronomy and Astrophysics*, 540. [11] Vitense, C., et al., (2014) *Astrophysical Journal*, 147, 154.